

be taken without sensible error as constant throughout small distances near P. The same method applies *mutatis mutandis* to temperature.

The chapter on the diffusion of gases from the point of view of thermodynamics requires more explanation than the author has directly given. He says (p. 125):—

“When two gases at equal temperature and pressure mix by diffusion, the gain of entropy is the same as would occur if each were to expand by escaping into vacuum till it occupied the volume of the mixture.”

To this *Advocatus Diaboli* would say, If instead of two gases you have two quantities of the same gas, oxygen, *caeteris paribus*, the whole system remains throughout in the same physical state, and, therefore (art. 86 [2]), there is no gain of entropy. What difference can it make that one volume of oxygen is replaced by nitrogen?

I think Prof. Bryan would justify his statements thus:—He asserts, art. 124 (a), “as two gases at equal pressure and temperature in general tend to mix by diffusion and not to separate, the process of diffusion is irreversible.” And he implies (b) that every irreversible process necessarily involves increase of entropy. If these principles (a) and (b) be granted, 125 is probably justified. But they are both very questionable.

It is not possible within the limits of this notice adequately to discuss either (a) or (b). I would, however, point out that in diffusion, as in all motions of gases, if at any instant the velocities of all the molecules were reversed the system, if isolated, would retrace its course. Does not this fact make a broad distinction between diffusion of gases and irreversible processes usually admitted as such?

S. H. BURBURY.

### VOLCANOES.

*I Vulcani Attivi della Terra. Morfologia—Dinamismo—Prodotti Distribuzione Geografica—Cause.* By G. Mercalli. Pp. viii+421; illustrated (Milano: Ulrico Hoepli, 1907.) Price 10 Ls.

THIS history of the study of volcanoes may be divided into three periods; the earliest is covered by the fragmentary remains of the writings of classical philosophers and the sporadic records of great eruptions of Vesuvius and Etna during the Middle Ages; the second commenced with the eruption of Vesuvius in 1631, which gave rise to over 200 publications, and from this date on we have a fairly complete record of the activity of Vesuvius and Etna; in the third period, observation became systematised, and vulcanology, as a science, may be said to date from Spallanzani's study of Stromboli in 1788. In the nineteenth century the science expanded its boundaries, volcanoes in other parts of the world besides Italy began to be studied, experimental methods were applied to elucidating the mechanism of eruptions and the formation of volcanic rocks, and the microscope to the investigation of their composition and structure.

As a consequence of this expansion of the science it has come to pass that we have had to look, not

to Italy, but to other countries, and especially to England, for a general handbook; Prof. Mercalli has rectified this, and the country where the study of volcanoes, and the science of vulcanology, took their birth has produced the best and most complete guide to their pursuit. In the compass of a moderate sized book, we have a remarkably complete, well-balanced review of the subject, which commences with the final result of volcanic activity, in an account of the rocks produced, and works back through the forms of volcanoes, their dynamics, and distribution, to the cause of volcanic activity.

The longest and most generally interesting chapter in the book is doubtless that dealing with the dynamics of volcanoes. Fissure eruptions and the outflow of lava without the formation of a volcanic cone are recognised, and in the classification of volcanic explosions we come across a third type—in addition to the familiar vulcanian and strombolian types—in what are termed plinian eruptions. This name is applied to the violent explosive eruptions, like that of Vesuvius in 79 A.D., of Bandaisan and of Krakatoa, which follow prolonged periods of repose, are of extraordinary violence, are accompanied by comparatively little or no outpouring of lava, while causing the ejection of large volumes of previously solidified material, and are succeeded by another period of repose. The eruptions of Pelée and St. Vincent in 1902 are regarded as differing in degree only, not in kind, from other known eruptions; the celebrated spine of Pelée, which was thrust up to 1000 feet above the crater, was an extreme case of extrusion of solidified lava, and the “black cloud” an extreme case of the avalanches of incandescent ashes which are a not uncommon accompaniment of great eruptions.

In dealing with the cause of volcanic activity, Prof. Mercalli favours the view, first propounded by Seneca, that it is produced by the access of sea water to highly-heated material in the interior of the earth, resulting in the production of high-pressure steam; but here, as elsewhere throughout the book, the theory is not pressed, and alternative explanations are fairly stated. A word, too, may be said for the illustrations, which are numerous and excellent.

### OUR BOOK SHELF.

*Shaft Sinking in Difficult Cases.* By J. Riemer; translated from the German by J. W. Brough. Pp. xii+122; with 18 illustrations and 19 folding plates. (London: Charles Griffin and Co., Ltd., 1907.) Price 10s. 6d. net.

MR. RIEMER is one of the leading German authorities on sinking, and a translation of his valuable treatise forms an addition to English technical literature that is specially welcome in view of the fact that shaft sinking, the most complicated of all mining problems, is necessarily dealt with in a brief manner in the standard works on coal-mining. The volume is confined to a description of means that have to be resorted to when ordinary methods of sinking cannot be applied on account of excessive influx of water, the means described being shaft sinking by hand, boring shafts, the freezing method of sinking, and the sinking-drum method.

The particulars given relate exclusively to recent

practice in Germany, where, unfortunately for the colliery owners, the subject of shaft sinking in circumstances of special difficulty has necessarily received special attention. Some of the difficulties recorded are appalling. For example, the sinking of a shaft at the Rheinpreussen colliery occupied twenty years, and at the Friedrichshall shaft sinking thirty-four yards cost no less than 437*l.* a yard with the shaft-boring process, whilst the unsuccessful attempt to sink ten yards by pumping cost 1563*l.* per yard. The author favours the Kind Chaudron method of sinking by the process of boring, a method that has never been known to fail. The freezing process, which was devised in 1883, has been applied in sixty-four cases, the deepest being at the Schieferkaute mine, where the ground had to be frozen to a depth of 240 yards. The depths that can be dealt with by this process are limited by the plasticity of ice.

The value of the author's detailed descriptions is greatly enhanced by the large-scale dimensioned drawings of the various shafts. On the whole, the volume furnishes those in charge of mining undertakings with a review of the various methods that may be used in difficult cases of sinking, so that the selection of the best method for any particular case is facilitated. It is not a book for elementary students, but one that deserves the careful study of advanced students and of experienced engineers. The translation has been carefully made, and a bibliography and index, that are wanting in the German edition, are undoubtedly valuable additions.

*Die philosophischen Grundlagen der Wissenschaften.*

by Prof. B. Weinstein. Pp. xi + 543. (Leipzig and Berlin: B. G. Teubner, 1906.) Price 9 marks.

THIS volume contains a series of thirty-five lectures originally delivered in the University of Berlin. A wide range of subjects is treated—from sense-perception to time, space, causality, substance, hypothesis, explanation. As the lecture form is preserved, the discussion never becomes crabbed or too compressed—a great virtue in a book—and the author moves naturally and easily whithersoever the topic leads him. He touches no subject without elucidating it, and the hope expressed in the preface that the work will be of some value alike to specialists and ordinary readers will, we are sure, be amply fulfilled. In particular the work may be heartily recommended to young philosophical students with some knowledge of German who are trying to crack some of the nuts of psychology and metaphysics. Had Prof. Weinstein but added at the end of each chapter a short list of other discussions of his subject that might profitably be consulted, our gratitude would have been even greater than it is.

A few indications of the author's standpoint and mode of treatment must be given. The attempt to "explain" phenomena of consciousness by physical terms like attraction, pressure, vibration of molecules, and the like is well characterised on p. 54, where it is pointed out what utter folly it would be thought to "explain" in the same way the inertia of lifeless substances as caused by vibrations of the substance. How competing perceptions are unified is a topic that occupies several excellent pages. We see things upright, although the retinal image really shows the object in an inverted form. Prof. Weinstein is at pains to contest the view that this takes place because the judgment of the sense of touch is so powerful as to overwhelm that of the sense of sight. He points out, for example, that all orientation in space takes place with reference to our bodies, and we judge according to the movements which we perform with parts of our bodies. "Below" means what we have to bend our bodies to touch; "above" what we must stand on

tip-toe to touch. If we saw everything inverted, according to the information supplied by the retinal image, we should see our bodies as well in an inverted position. Hence the sense of touch, and the sense would always give harmonious judgments. The treatment of the *a priori* nature of Zeitlichkeit and of the whole subject of causality leaves little to be desired, and atomism and æther have a few illuminating paragraphs. It is an excellent volume in every way.

*The Toxins and Venoms and their Antibodies.*

By Em. Pozzi-Escot. Authorised translation by Dr. Alfred T. Cohn. Pp. viii + 104. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1906.) Price 6*s.* 6*d.* net.

WE regret that we are unable to speak favourably of this little book. In 100 short pages an attempt is made to survey the whole domain of toxins, bacterial, vegetable, and animal, of the venoms and of antitoxins, with the result that it is superficial and sketchy. It teems with errors in spelling, and with curious sentences, probably due to faulty translation, e.g. Micocher for Miescher, Rauson for Ransom, tumors for humors, Chauvée for Chauveau, Zalnosky for Zalensky, methylotoxin for mytilotoxin, &c.; mussels are spoken of as crustacea, and scorpions as insects; it is stated that "toxins act as toxic agents only when in a condition to be introduced into the circulation sub-cutaneously," "the action of bee poison is very often benign," "*in vitro* it (antivenine) acts quite as well preventively as therapeutically," and so on.

R. T. HEWLETT.

*Everyman's Book of the Greenhouse (Unheated).* By W. Irving. Pp. 247. (London: Hodder and Stoughton, n.d.) Price 5*s.* net.

THE designation "*Unheated*" is a convenient term to denote a greenhouse in which there is no set heating apparatus. A small stove that will keep out the frost adds materially to the utility of a greenhouse, as it is thus possible to provide a winter domicile for half-hardy plants, besides enabling the possessor to force plants into growth and prepare plants for window boxes or house decoration.

The author has extended the limits of his selection to include alpine plants and others that are especially suitable to pot culture. The directions as to choice and management are based on Mr. Irving's long experience at Kew, and are simply and clearly expressed. The longer paragraphs, such as that on the genus *Primula*, are the most instructive, and since it is easier to grow a few kinds well, these might have been amplified to the exclusion of certain of the less important genera. The numerous photographs are very effective and fascinating, but the coloured plates are not attractive.

"*Mephistopheles.*" *The Autobiography and Adventures of a Tabby Cat.* By Keiro (Charles Yates Stephenson); with illustrations by Louis Wain. Pp. 158. (London: Jarrold and Sons, n.d.) Price 2*s.* 6*d.*

AN interesting account is given of the episodes in the life of a cat possessed by Mr. Stephenson for more than eighteen years. The narrative and the excellent illustrations will both appeal to young people.

*Healthy Boyhood.* By Arthur Trewby; with an introduction by Sir Dyce Duckworth, and a Foreword by Earl Roberts. Pp. viii + 63. (From the author.) Price 1*s.* 6*d.*

THIS booklet contains useful advice to boys, expressed in a temperate manner; it may be commended to the attention of parents and schoolmasters.